Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 6 Issue 2 February 2023

Case Report

Arthroscopic Suture Augmentation with Laxity Anterior Cruciate Ligament: A Case Report with Video Illustration

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DOI: 10.31080/ASOR.2023.06.0685

Received: December 19, 2022

Published: January 24, 2023

Abstract

We describe a suture tape augmentation technique for tightening the lax primary anterior cruciate ligament (ACL). Due to advances in arthroscopic technique and understanding of the ACL's healing process, ACL augmentation can be used as an alternative treatment for lax ACL. This procedure aims to preserve the native ACL and provide more feasible options for the lax ACL, enhancing ligament strength, knee stability, and function. A 34-year-old female presented to our outpatient clinic with a left knee ACL lax that was treated with arthroscopic ACL suture augmentation and meniscal repair without postoperative complications. Before deciding on ACL tightening surgery, intraoperative ligament probing is required to determine the grade of laxity. This article aims to illustrate the lax ACL tightening technique using augmentation to avoid unnecessary ACL reconstruction and simplify the surgical procedure. With video illustrations, this article will also help orthopaedic surgeons attain effective outcomes.

Keywords: Anterior Cruciate Ligament; ACL Laxity; Partial Tear; Arthroscopy; Case Report

Introduction

The ACL is a collagenous structure that stems at the posteromedial aspect of the lateral femoral condyle and inserts anteriorly to anterior to the intercondylar eminence of the tibial articular surface [1]. It accounted for up to 86 percent of the total force-resisting frontal draw and acted as the primary rigid stabilizer against the anterior translation of the tibia on the femur [2]. Moreover, ACL injuries are among the most common knee injuries sustained by athletes while participating in sports [3]. Over the last five decades, ACL surgical intervention has changed substantially [4]. However, ACL reconstruction (ACLR) has remained the gold standard for treating ACL injuries, particularly in young people and athletes [3]. The main objective of ACLR is to restore knee stability, enabling the patient to resume previous levels of physical activity while reducing the occurrence of articular cartilage degeneration [5]. Although the lax ACL has received little attention because it has traditionally been treated non-operatively, the advantages of lax ACL tightening over reconstruction include the preservation of native ACL, avoiding harvesting grafts, and, as a result, faster recovery and earlier rehabilitation [6]. Rather than choosing ACLR right away, ACL tear necessitates careful consideration and weighing each treatment option. This tightening technique is recommended for lax ACL, and while various ACL repairs exist, this technique has yet to be published in the current literature. This article proposes an arthroscopic suture augmenting technique for tightening the lax primary ACL, strengthening the ligament, and improving knee stability and function.

Case Report

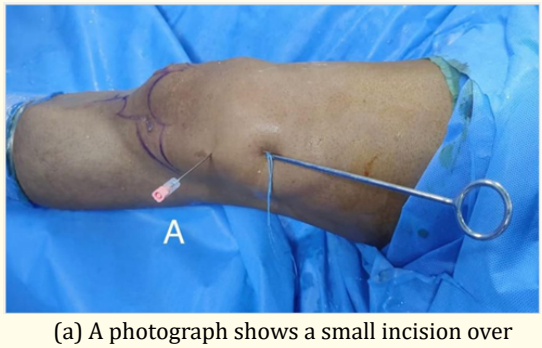
We report a case of a 34-year-old female who presented to the outpatient clinic with complaints of left knee pain for 3 months. She reported having twisted her left knee while playing soccer, and the pain gradually intensified as she climbed stairs. On physical examination, there was a mild left knee effusion with a positive Lachman, Anterior Drawer, and McMurry test. Magnetic resonance imaging was performed, which revealed a partial tear of the anterior cruciate ligament and the medial meniscus. A radiographic examination of the left knee showed a normal bone Configuration with no concomitant fractures, whereas an MRI revealed a partial tear of the anterior cruciate ligament and medial meniscus. Following informed consent and pre-operative optimization, the patient was taken to the operation room for arthroscopic ACL suture augmen-

tation and meniscal repair. The surgical procedure was successful, with good knee function and stability outcomes. At 3 years of follow-up, the patient's progress had continued to be substantial.

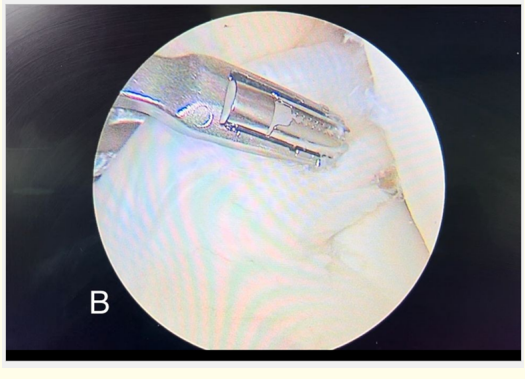
Surgical technique (with video illustration)

A single senior surgeon (DS) performed the arthroscopic suture tape augmentation technique (Figure 1). A primary ACL augmentation can be performed with a standard operating table with a tourniquet and lateral post support in the proximal thigh. All patients were positioned supine and were given combined spinal and epidural anaesthesia. We prepped and draped in a conventional sterile fashion. Before initiating the surgery, a physical examination of the knee is performed while the patient is under anaesthesia to assess the grade of the lax ACL (e.g., Anterior drawer, Lachman test, and pivot shift test). We regularly use two portals, and after establishing these standard portals (AL and AM portals), the ACL was probed and discovered to be lax. A systemic arthroscopic assessment of the knee was performed to rule out any other associated injuries before deciding on ligament tightening. The results were first documented in the operational records. Meniscal repair, synovectomy, or removal of loose bodies were conducted when necessary.

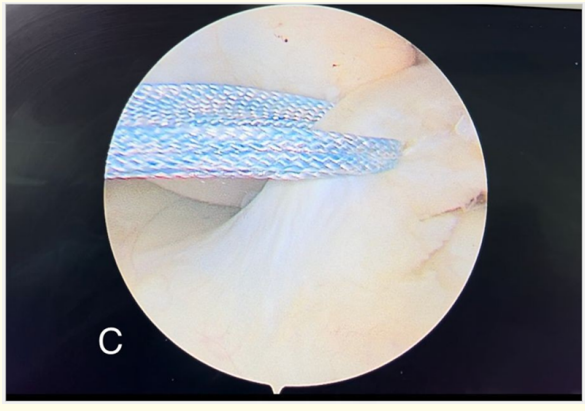
We decided to tighten the lax ACL with FiberTape (Arthrex) augmentation and preserve the ligament if it had a uniform and good-quality tissue. Initially, multiple drill holes are performed in a microfracture fashion through the anteromedial working portal, followed by creating a single femoral tunnel inside out at the anatomical insertion point of the femoral footprint with full knee flexion using a 4.5 mm drill guide pin (Arthrex). Then, the loop (Ethibond no. 2 suture Ethicon Inc, USA) is passed. Second, we used a suture passer instrument, a suture Lasso (Arthrex) or FIRSTPASS suture passer (Smith and Nephew) (Figure 2.b). The first suture was placed across the ACL middle to proximal towards the femur and from lateral to medial. The suture was loaded back into the self-retrieving suture passing device. This method was repeated 3 to 4 times (Figure 2.c) similarly, until the augmentation tightening was deemed adequate. Suture augmentation was appropriately placed, and grasper was used to retrieve the free ends of the FiberTape, which were pulled into the femoral tunnel after being shuttled in the loop. Third, the FiberTape exit site was then identified by making a mini-incision on the lateral aspect of the femur side (approximately 3 to 4 cm from the joint line) (Figure 2. a). Following that, both edges of the FiberTape were passed through Endobutton (Smith and Nephew, Andover, Mass, USA) and tightened over the lateral aspect on the femur side with a knot pusher (Figure 2.d) while the knee was in 30o of flexion. The remaining suture is cut with a suture cutter. Finally, the ACL was probed (video 1), and the tightness was confirmed before closing the mini-incision and portals. Following the procedure, a local anaesthetic was induced into the operated knee joint, and a crepe bandage and a knee brace were applied. As a result of restoring the ACL to nearly its initial tension, this is now more functional. Video 1 shows all the steps of this technique with video narration. Table 1 presents this technique's indications, advantages, and disadvantages.



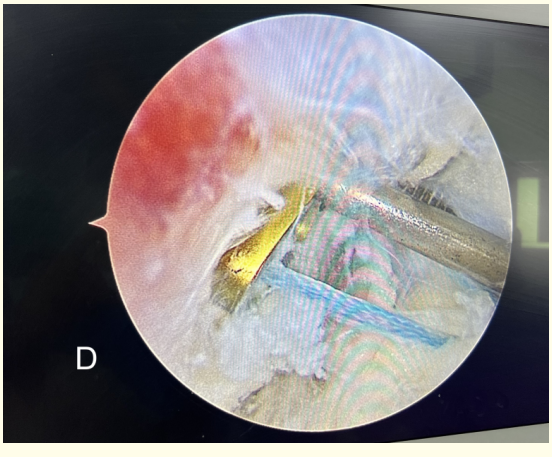
(a) A photograph shows a small incision over the lateral aspect of the femur.



(b) Arthroscopic viewing from anterolateral portal shows FIRSTPASS suture passer (Arthrex).



(c) The first suture was placed across the ACL from middle to proximal towards to the femur and the suture was repeated 3 to 4 times.



(d) Arthroscopic viewing from anteromedial portal shows endobutton.

Figure 2

Postoperative rehabilitation

All patients should be instructed to modify their lifestyles to protect the tightened ACL while progressing gradually and avoiding deep knee flexion. There is no specific post-operative management for the tightened ACL. However, the post-operative rehabilitation protocol is based on standard recommendations for ACL reconstruction. This protocol includes a knee brace for 6 weeks with a range of motion of 0° to 90° and full weight bearing with a walker.

In patients who underwent additional surgery (such as meniscal repair), partial weight bearing was recommended as tolerated, and the early rehab phase focused on the regained range of motion.

Sports participation is permitted after 9 months, depending on the type of sport and knee function.

Discussion

This article demonstrates a suture tape augmentation technique that is the simplest way of tightening a lax ACL. This technique does not require much special equipment and produces positive outcomes. Standard arthroscopic portals are required (AL and AM portals). The first ACL surgical intervention was ACL repair, but the outcomes were never reliably reported [7].

According to the recently published meta-analysis, in 1101 patients, primary repair without static or dynamic augmentation was safe, with failure rates ranging from 7 to 11% and good functional outcome scores. Dynamic augmentation repair was associated with higher re-operation rates (10%) and hardware removal rates (29%) [8]. Other studies demonstrate ACL augmentation repair. It resulted from our understanding of the basic biology underlying human ACL tissue repair [6]. However, the amount of reliable

Indications	Advantages	Disadvantages
ACL tear (Moderate laxity) was confirmed during diagnostic arthroscopy.	The native ACL is preserved.	If the torn ACL tissue is poor quality, suture tape tightening is difficult.
	No graft harvesting is required.	
	STA leads to earlier rehab than ACLR	
Good ACL tissue quality.	The revision is not as complicated.	The ligament may be disturbed by several retrieved sutures.
	ACLR is more invasive than suture tape tightening.	

Table 1: Indications, Advantages and Disadvantages of the suture tape augmentation.

Note: ACL: Anterior Cruciate Ligament; ACLR: ACL Reconstruction; STA: Suture Tape Augmentation

evidence from clinical studies utilizing modern ACL augmentation techniques is limited [9]. Thanks to the sophisticated arthroscopic techniques and improvements in MR Imaging that are now widely available, we can identify patients most likely to benefit from primary ACL augmentation.[10] The best way to detect ligament laxity is to probe the ACL. Therefore, this technique will provide more alternatives instead of unnecessary ligament reconstruction.

In recent years, there has been a regain of interest in primary ACL repair [11] because of its several advantages, which include preserving mechanical receptors, less morbidity, earlier rehabilitation, protection against ligament strains or elongation during healing, and no graft harvesting required.

Moreover, it provides a robust initial holding strength, which boosts the possibility of healing.

There were a few studies published on the modification of suture tape augmentation [8]. Our technique is the first to demonstrate this tightening of the lax ACL with Endobutton instead of anchor. It also strengthens the repair and minimises damage to surrounding structures. Moreover, Endobutton is affordable, and ACL reconstruction would be simpler to use in case of augmentation failure. The main goal is to preserve the native ACL, restoring knee stability and maintaining proprioception. So far, this arthroscopic technique for tightening the lax ACL shows positive results without complications and early rehab, especially for the lax ACL. More research is needed to determine long-term outcomes and second-view arthroscopy.

Conclusion

This arthroscopic suture tape augmentation technique provides various benefits when used to tighten the lax primary ACL, and patient selection is one of the essential steps in this procedure. This approach is less expensive than other ACL repairs because it requires less specialized equipment. This procedure aims to preserve the native ACL and provide more feasible options, but more research on failure rates and long-term follow-up is required. This procedure is safe and the simplest way of tightening a lax ACL with no complications.

Funding

None.

Ethical Clearance

No ethical committee approval was required for this study because ACL repair is not a novel procedure.

Competing Interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

Acknowledgement

None.

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